New taxa, a new record and a rediscovery in Western Australian *Haloragis* (Haloragaceae)

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Abstract

Orchard, A.E., Lepschi, B.J. and Hislop, M. New taxa, a new record and a rediscovery in Western Australian *Haloragis* (Haloragaceae). *Nuytsia* 15(3): 431–443 (2005). Variation and distribution in taxa of the *Haloragis gossei–H. trigonocarpa* group is discussed and two new taxa, *H. maierae* Orchard and *H. gossei* var. *inflata* Orchard are described. Rediscovery of *H. platycarpa* is noted, and an amended description of this rare species is provided. Variation in the *H. aculeata–H. scoparia* group is discussed, and a widely disjunct new record, *H. glauca* forma *glauca*, is noted for the State.

Introduction

Haloragis is a genus of 28 species, largely confined to Australia, with just four species extending to islands of the Pacific (Vanuatu, New Caledonia, New Zealand, Cook Islands, Rapa, Juan Fernandez) probably by relatively recent long-distance dispersal. The species are essentially temperate in distribution, extending into eremaean regions, but are absent from most tropical regions. Most are found on loam or clay soils, although annual eremaean species are found on sandy substrates. Two species are aquatic or subaquatic. Nowhere is *Haloragis* a dominant taxon, but in southeastern Australia some species (such as *H. aspera*, *H. glauca* and *H. heterophylla*) show weedy proclivities and are minor weeds of agriculture and horticulture.

Most eastern species are relatively widespread, and few are rare or endangered. In Western Australia the situation is somewhat different. The eremaean species are widespread and relatively common, but the temperate taxa from wetter areas are mostly very rare and scattered. This may be due in part to a scarcity of heavier soils in the better watered areas of southern WA, and in part to widespread clearing, particularly in the wheatbelt. The lack of collections may also be due to them being rather inconspicuous plants. Whatever the reason, *Haloragis* in southern WA contains a disproportionately high percentage of poorly known, poorly collected, and apparently very restricted species. This paper re-examines some of them in the light of newly available material.

Materials and Methods

This study is based on examination of selected herbarium collections from AD, CANB, MEL, NSW

and PERTH. All measurements were made from herbarium material (reconstituted where necessary). See the end of this issue for definitions of conservation codes used in this paper.

The *Haloragis gossei* complex

In previous papers (Orchard 1975, Orchard 1990) it was recognised that *Haloragis gossei* and *H. trigonocarpa* were closely allied, and formed a distinctive subgroup within the genus. They are characterised by being eremaean in distribution (most other species are temperate, from seasonally wet areas, some even being aquatic or subaquatic), they are trimerous (most other species are 4-merous, although a few are 1-, 2- or 3-merous), annual (most others are perennial), and they have well developed papery wings on the fruit, presumably to facilitate wind dispersal (in other species with winged fruits, e.g. *H. acutangula* and *H. odontocarpa*, the wings are not consistently developed, and they are thick and sub-woody, not papery).

Haloragis gossei and *H. trigonocarpa* are clearly closely related, and can only be reliably distinguished from each other by characters present in their mature fruits.

H. gossei has fruits which are usually 6.5–8 mm long and 5.5–8 mm wide (including the wings). About 3–5 main veins arise from the body of the fruit and extend into the wings to form 'struts'. These veins are obvious but not particularly woody. The islets between these main veins are covered by the papery exocarp, which is opaque. The 'struts' plus their covering have a flexible, parchment-like texture. About two thirds to three quarters of the way to the margin of the wings the main veins link to form an arching intramarginal vein. Beyond this, numerous small dichotomising veins extend almost to the margin of the wing. As the fruit develops the sepals enlarge considerably. In the mature fruit they generally bear three main veins – a central vein which runs almost to the tip of the sepal with two prominent lateral veins departing at 90° about two thirds of the way to the tip (forming a cross), and two lateral unbranched veins which usually curve gradually to the lateral corners of the sepal. The fruit in *H. gossei* is always glabrous, as is the rest of the plant.

H. trigonocarpa has much smaller fruits, usually 4.0–4.5 mm long and 2.5–3.5 mm wide (including the wings). Again, about 3–5 main veins arise from the body of the fruit and extend into the wings as 'struts'. However, the 'struts' in this species are far more woody than in *H. gossei*, making the wings rigid, rather than parchment-like as in *H. gossei*. Furthermore, the exocarp covering the 'struts' is much thinner and almost translucent, resulting in the wings appearing to have windows in them (i.e. the effect is that of the wings of a dragonfly or of many Diptera). As in *H. gossei* the main veins in the wings link to form an intra-marginal vein, but in this species this intramarginal vein is much woodier, closer to the margin, and lacks the fringe of fine dichotomising veins beyond. The sepals in *H. trigonocarpa* also increase in size with the fruit, but they bear only the trident-shaped central vein. The two lateral veins in the sepal do not develop or are insignificant. The fruit in *H. trigonocarpa* is usually glabrous, but sometimes it bears very short (0.1 mm) simple hairs on the body of the fruit, not extending to the wings. In specimens of this latter variant (e.g. *Phillips* s.n., CBG 031071) the remainder of the plant is glabrous as in *H. gossei*.

The two species overlap in distribution to some extent, although *H. gossei* tends to be more northerly and easterly, being most common in central Australia and the Pilbara/ Hamersley Range area of Western Australia (the latter an area bounded roughly by Port Hedland, Newman and North West Cape). *H. trigonocarpa* is confined to Western Australia, and is most common in the Goldfields area, but

extends in an arc to Shark Bay and the coastal area north from there to North West Cape. Outliers are known for both species beyond the above areas. The two species overlap in distribution or come close together in the Kalgoorlie–Leonora district, and in the Exmouth Gulf–North West Cape area.

1. Introgression between *H. gossei* and *H. trigonocarpa*

Given their close relationship, and a partly overlapping distribution, it is not surprising to find a number of collections in which the fruits are somewhat intermediate between *H. gossei* and *H. trigonocarpa*, suggesting a small degree of introgression or hybridisation. The fruits of these putative hybrids are generally more variable on individual plants than is the case with plants of either of the parent species, and they are usually intermediate in their characteristics. They usually measure about 5–6 mm in length and width (including wings), the main venation is usually fairly woody, but the islets are opaque, and the fringing fine dichotomous veins at the margin of the wings are usually present. Sepal venation varies from that typical of *H. gossei* to that of *H. trigonocarpa*, often on the same plant. The intermediate collections are largely confined to the margins of the Pilbara, in the main region of species overlap, but they might also be expected to be found in the Goldfields. From the variability observed it seems likely that many of these specimens represent backcrosses to one or other of the parent species, and not just F1 hybrids.

Putative hybrid specimens examined. WESTERN AUSTRALIA: 26 km S of Mt Newman turnoff on Great Northern Highway, 11 Sept. 1978, *A.C.Beauglehole* 59353 & *E.G.Errey* 3053 (PERTH); 4 km N of Nullagine P.O. on Great Northern Highway, 5 Aug. 1974, *G.W.Carr* 4650 & *A.C.Beauglehole* 48428 (PERTH); 10 mls [16 km] S of Onslow, 28 Aug. 1960, *A.S.George* 1144 (PERTH); About 5 km N of Munjina roadhouse on Newman road, 3 Sept. 1995, *A.A.Mitchell* PRP592 (PERTH); About 10 km E of Munjina roadhouse on Roy Hill road, 3 Sept. 1995, *H.J.R.Pringle* PRP587 (PERTH); Little Sandy Desert, W apron of Cooma Well, 16 Apr 1997, *S. van Leeuwin* 3098 (CANB, KARR., PERTH).

Distribution. Confined to Western Australia at the western and eastern margins of the Pilbara, and may be expected to be found in the Kalgoorlie–Leonora area of the Goldfields.

Habitat. Most specimens lack information on habitat. *Mitchell* PRP592 was described as infrequent in *Acacia distans* tall shrubland. *Pringle* PRP587 was described as infrequent in *Triodia lanigera* hummock grassland on a colluvial slope from ironstone ranges. These sparse notes suggest that the intermediate plants, like their parent species, are opportunistic annual colonisers, not particular about substrate or position.

Phenology. Flowering occurs in August and fruits develop very quickly, being apparently fully mature in September. A substantial proportion of the fruits bear apparently normal, viable seed.

2. A new species: *Haloragis maierae*

In previous papers (Orchard 1975, Orchard 1990) passing reference was made to occasional 4-merous specimens of both *H. gossei* and *H. trigonocarpa*. Additional good quality 4-merous specimens from this complex are now known, and it is clear that an additional species is involved. This species shares the annual life-form of *H. gossei* and *H. trigonocarpa*, their more or less glabrous habit, and their eremaean distribution. Superficially it resembles these two species, but on close examination is clearly distinct in its 4-merous flowers and fruits. In this respect it forms a link between the *H. gossei* complex and the core species of the genus. The new species is described below:

Haloragis maierae Orchard *sp. nov.*

Species *H. gossei* et *H. trigonocarpam* similis. Herba annua (10–) 20–30 cm alta, glabra vel pilis sparsis (vel initio densis) unicellulosis in partibus juvenibus. Flores et fructi 4-meri. Fructus 4-alatus, pallido-flavovirens, venis fuscatis, 6–7 mm longus, 5–6 mm latus; alae ad basim rotundatae, versus apicem dilatatae, truncatae sed lobo apicalo triangularo plusminusve acuto, areis intercostalibus papyraceis sed opacis. Alae venis principalibus 3-4, ex corpore fructus arcuatis, 'pluteis' formantibus. Sepala in fructus expansa; venae laterales curvatae, indivisae; vena mediana versus apicem trifida.

Typus: About 25 km SSW of Hamersley Station Homestead, 5 June 1994, *A.A. Mitchell* 3620 (*holo*: PERTH 04055322; *iso*: CANB; KARR. *n.v.*)

Annual *herb* (10–) 20–30 cm tall, glabrous, or with sparse (or initially dense) minute (<0.1 mm) unicellular hairs on young parts, soon glabrescent. *Stems* erect, branched mainly at base, terete or faintly ribbed. *Leaves* alternate (basal pair subopposite), somewhat fleshy, linear to narrowly ovate, 17–30 mm long, 2.0–2.5 (–6.0) mm wide, margins ± entire or with (0–) 1–3 widely spaced forward-pointing triangular teeth 0.3–0.5 (–1.0) mm long on each side; tip acute; lamina tapering gradually to base to form a 'petiole' c. 3.5–5.0 mm long; midrib faintly visible in dried specimens, other veins obscure. *Bracts* green, leaf-like, reduced, virtually absent in upper part of inflorescence. *Bracteoles* straw-coloured, linear, 0.5 mm long, entire or with a few minute hair-like teeth. *Flowers* in 3s in axils of bracts, 4-merous. *Sepals* 4, ovate, with a small callus at base, persistent and increasing greatly in size in fruit. *Petals* 4, strongly hooded, *c.* 1–1.2 mm long, yellowish to reddish. *Stamens* 8, filaments *c.* 0.3 mm long; anthers yellow, shortly oblong, 0.7–0.8 mm long, non-apiculate. *Styles* 4, *c.* 0.5 mm long; stigmas capitate, sparsely fimbriate. *Ovary* 4-angled, 4-locular. *Fruit* pale yellowish green with prominent darker veins, 4-winged, 6–7 mm long, 5–6 mm wide; intercostal areas papery but opaque. Wings rounded at base, gradually increasing in width towards apex, apex shortly apiculate; venation very obvious, of 3 or 4 major lateral veins arising from the body of the fruit and extending two-thirds to three-quarters of the way to the margin before dividing into numerous smaller veins, intra-marginal vein absent. Major lateral veins arching out (away from) the body of the fruit to form 'shelves'. Fruiting sepals persistent, broadly ovate, 1.7–2.0 mm long, 2–2.5 mm wide, strongly 3-veined in lower half; lateral veins undivided and diverging to margins, rarely very faint; central vein trifid towards tip; sepals incurved over a well-like hollow at apex of fruit. Seeds 1 per locule. (Figure 1A–B)

Other specimens examined. WESTERN AUSTRALIA: 22 km NW of Mt Tom Price, 16 June 1970, *B.G. Briggs* 3622, (NSW); Near Kalgoorlie, Apr. 1925, *W.H. Halford s.n.* (PERTH); Hamersley Iron's 'Silvergrass' lease, c. 70 km NW of Tom Price, 29 Aug. 1998, *M. Maier s.n.* (CANB); Wanna Munna Flats area, c. 9 km NNE of Giles & 63 km WNW of Newman, 19 Oct. 2003, *M. Maier & K. McCreery* 547 (CANB, KARR., PERTH); *loc. cit.* but 68 km WNW of Mt Newman, 23 Oct. 2003, *M. Maier & K. McCreery* 548 (PERTH); Murrin Murrin, Leonora, Goldfields, 16 Aug. 1995, *D. True* A 3.34 (PERTH); Barlee Range Nature reserve, 10.8 km W of Mt Palgrave, 7 Aug. 1993, *S. van Leeuwen* 1434, (PERTH); Little Sandy Desert, 28.7 km NE of Kulonoski East Well, 23 Oct 1996, *S. van Leeuwen* 2975 (CANB, KARR., PERTH); Munjina Claypan, Juna Downs Station, 14.6 km S of Mt Lockyer, Hamersley Range, 15 Sep. 1998, *S. van Leeuwen* 3895 (CANB, KARR. *n.v.*, PERTH); West Angelas area, 22.6 km SSE of Mt Meharry, Hamersley Range, 16 Sep. 1998, *S. van Leeuwen* 3975 (CANB, KARR. *n.v.*, PERTH); West Angelas area, upper reaches of Turee Creek East Branch, 4.3 km E of West Angela Hill, Hamersley Range, 19 July 2000, *S. van Leeuwen* 4754 (CANB, KARR. *n.v.*, PERTH); Newman, *s. dat., K. Walker s.n.* (PERTH).

Distribution. Confined to inland Western Australia, where it is found discontinuously in an arc from the Hamersley Range through Leonora to the vicinity of Kalgoorlie. An additional specimen (*Nelson* 2384;

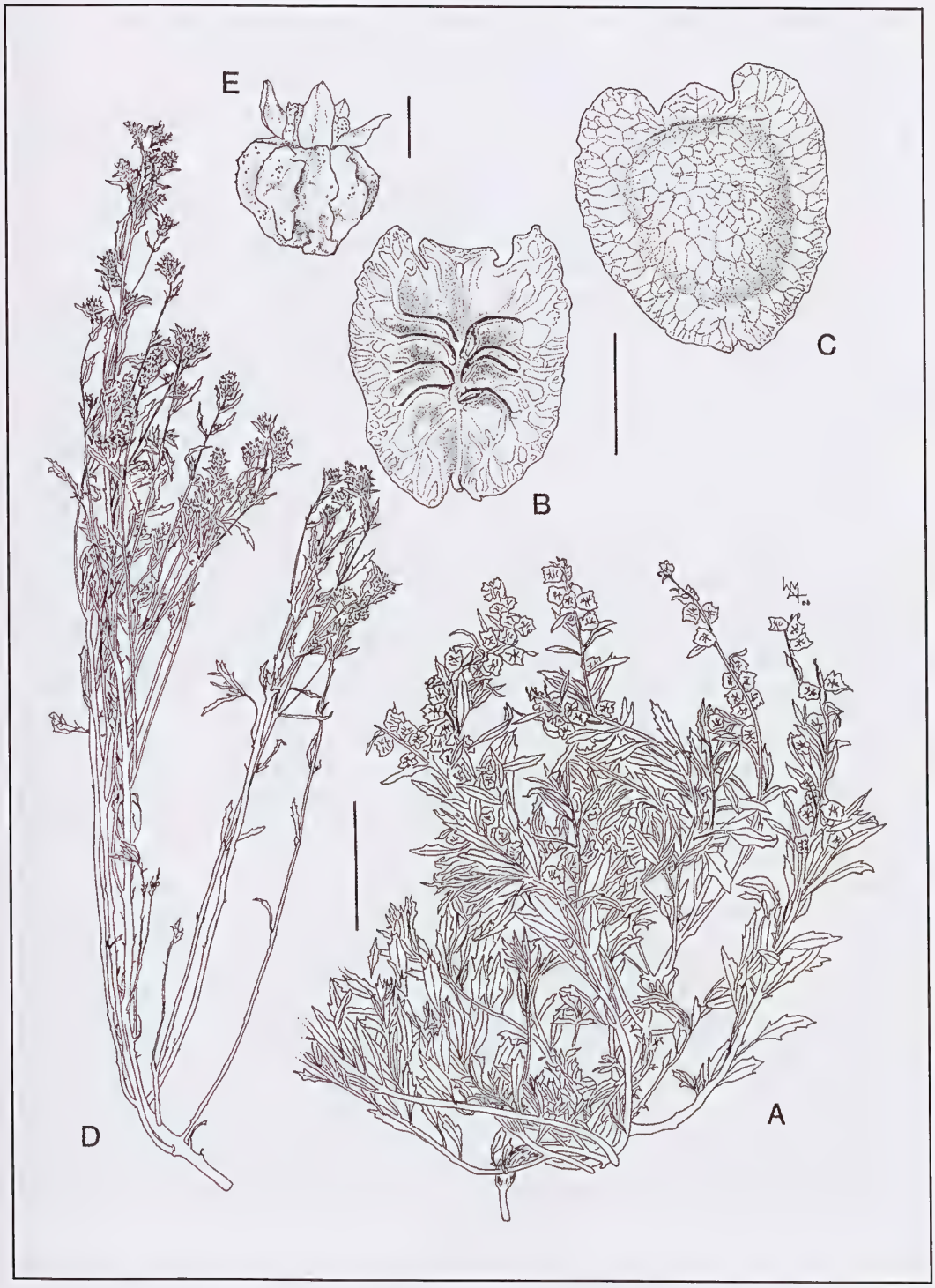

Figure 1. A–B. *Haloragis maierae*. A – habit, B – fruit; C. *Haloragis gossei* var. *inflata* fruit; D–E. *Haloragis platycarpa*. D – habit, E – fruit. Drawn from *Mitchell* 3620 (A–B), *A.S. George* 10218 (C) and *Hislop* 2134 (D–E). Scale bars: A & D – 4 cm; B & C – 3 mm; E – 1 mm.

CANB; AD, DNA *n.v.*) from Hamilton Downs Station in the southern Northern Territory probably also belongs to this taxon, although the prominent lateral veins in the fruit are not well developed. In all other respects the specimen is a good match for *H. maierae*. (Figure 2)

Habitat. In the Pilbara region, *H. maierae* has been recorded from grassland-herbfield communities, often with scattered emergent *Acacia* spp. (*Mitchell* 3620, *van Leeuwen* 3895, 3975), open *Acacia* spp. scrub with a variously developed understorey of shrubs, grasses and herbs (*van Leeuwen* 1434, 4754), clayey plain in *Eriachne benthamii* tussock grassland (*Maier & McCreery* 547), gilgai within a clayey plain, in mixed tussock grassland with *Aristida latifolia*, *Astrebla* sp. and *Eragrostis setifolia* (*Maier & McCreery* 548), open scrub of *Melaleuca* sp., over heath-low scrub of *Halosarcia* spp., over dwarf scrub of Goodeniaceae spp., over open herbs of *Zygophyllum* sp. and *Sclerolaena* sp. (*van Leeuwen* 2975), and open *Senna hamersleyensis* / *Eremophila maculata* shrubland over dense herbland (*Maier s.n.*). The single goldfields collection with habitat data (*True* A 3.34), records *H. maierae* as associated with *Acacia aneura*, *Pogonolepis stricta* and *Haloragis gossei*. In all instances soil types are either clay or clay-loam, except *van Leeuwen* 2975, which was recorded from loamy red brown sand over calcrete-gypsum at depth. The Northern Territory collection (*Nelson* 2384) was recorded from a chalcedony rise with *Triodia clelandii*.

Phenology. It is likely that flowering and fruiting in this species are opportunistic, depending on local rainfall to trigger germination and quickly complete its annual life cycle. The transition from flowering to fruiting seems to be rapid, with all stages present on a number of the specimens examined. Flowers are present on plants collected between June and September, and fruits on specimens collected in April and June through to September in Western Australia. The *Nelson* 2384 collection from the Northern Territory was flowering and fruiting in November. *Van Leeuwen* 1434 and *Briggs* 3622 represent very young, unbranched seedlings bearing no more than 10–12 leaves, but already flowering and bearing young fruit.

Affinities. Clearly allied to the *H. gossei–H.trigonocarpa* complex, sharing their annual life-form, soft (somewhat fleshy) glabrous texture of stems and leaves, and distinctly winged fruits. It forms a link between those species (which are 3-merous) and the 4-merous species which are at the core of the genus.

This species is distinguished from *H. gossei* and *H. trigonocarpa* by the hairs on very young stems and leaves, by the 4-winged fruits, and by the bizarre venation of the fruits. In these two species the 3–4 main veins running from the body of the fruit into the wings are flattened against the body of the fruit. Within the wings they form large lacunae before anastomosing and breaking up into numerous finer, radiating veins in the margin of the wings. In *H. gossei* the lacunae are opaque. In *H. trigonocarpa* the main veins are much more woody than in *H. gossei*, and the lacunae in the wings are almost transparent. In *H. maierae* the main veins from the body of the fruit begin by projecting outwards almost at right angles, before arching back into the wings. In doing this they stretch the papery exocarp over their basket-like framework, forming a series of 'shelves' between the wings. The arching main veins are very distinct in northern WA collections, but less pronounced in southern WA collections from near Leonora and Kalgoorlie. These southern collections also have less obvious lateral veins on the fruiting sepals. In *H. maierae* the lacunae are opaque, as in *H. gossei*. In fruit size, *H. maierae* is intermediate between the other two species.

Two specimens of undoubted *H. gossei* (3-winged fruits) are known in which the major veins are slightly arching, and thus resemble *H. maierae*. They are *T.J.Fatchen* 970 & 982 (both AD), both collected from the Great Sandy Desert at 19° 20' S, 125° 23' E. The first was growing on a sandridge crest, the second

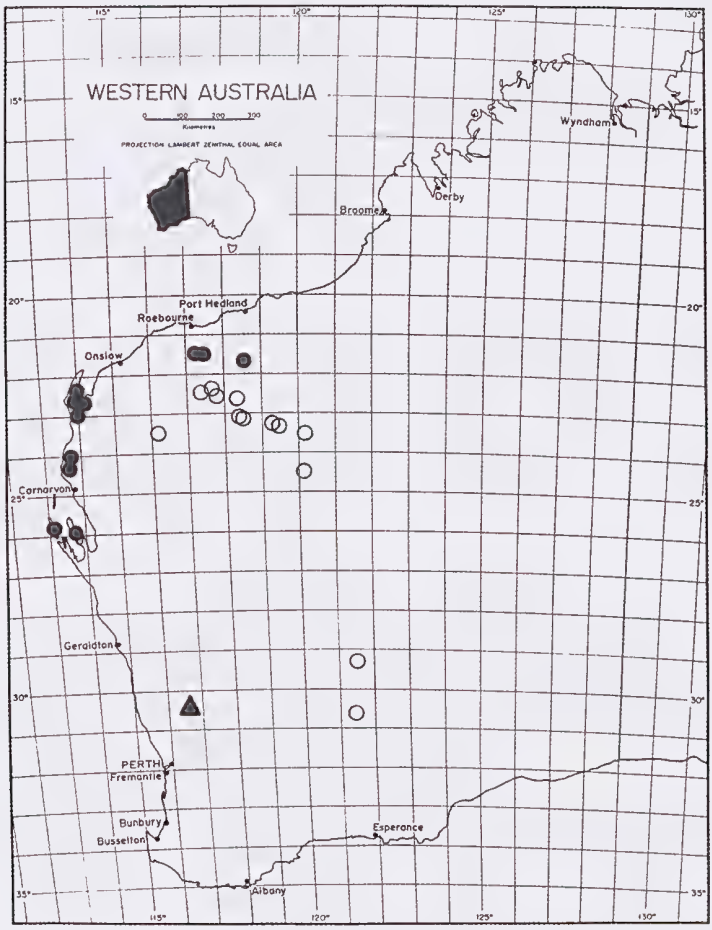

Figure 2. Distribution of *Haloragis gossei* var. *inflata* ●, *H. maierae* ○ and *H. platycarpa* ▲.

on the edge of a large termite mound in a damp depression. They are the only specimens that suggest the possibility of introgression between *H. gossei* and *H. maierae*.

Conservation status. The species is known from only a small number of collections, but these are spread across a very wide area. Superficially the species resembles *H. gossei* and *H. trigonocarpa*, and is more or less sympatric with both. It is likely that with careful examination of '*H. gossei*' populations *H. maierae* will be found to be much more common than is presently indicated. It is conserved at least within the Barlee Range Nature Reserve.

Etymology. Named for Ms Michi Maier, who first drew my attention to the species, collecting material north of Laverton.

Notes. In Orchard (1975) attention was drawn to an abnormal form of *H. gossei* from Maralinga in which some fruits were 4-winged and 2-locular. Another specimen (*H. Turner s.n.* (AD97604592)) is now known from the same area, and has the same general characteristics, although the 4-winged fruits seem to be 4-locular, not 2-locular. In both plants the majority of the fruits are typical for *H. gossei*, and the abnormal fruits are found sporadically in the inflorescence (perhaps 1 in 50). This unstable characteristic combined with other vegetative differences noted in Orchard (1975), and the locality, suggest that this might be a case of radiation-induced mutation (Maralinga was the site of several nuclear tests in the mid-20th century). In any case, they do not represent an outlier of *H. maierae*.

3. Inflated-fruit forms of *H. gossei*

In Orchard (1975) it was noted that some species in Haloragaceae develop an inflated exocarp. This phenomenon is of unknown significance. It seems to be unrelated to disease, but may provide additional buoyancy to the fruits for wind or water dispersal. It is ubiquitous in *Haloragis uncatipila*, which is clearly related to *H. aspera*, *H. glauca* and *H. dura*, all of which have uninflated fruits. *H. platycarpa* demonstrates the same phenomenon, but less markedly (see below). In *Glischrocaryon* a single species, *G. roei* has consistently swollen fruits; those of other species are usually uninflated (although occasional more or less inflated fruits are known in *G. aureum*). Similarly, in *Haloragodendron*, *H. baeuerlenii* has consistently inflated fruits, *H. glandulosum* has slightly inflated fruits, and the fruits of the other three species are uninflated.

In *Haloragis gossei* a slightly different process is occurring. In normal plants the body of the fruit is dry and crustaceous, with parchment-like wings arising, as previous described. At the base of each wing there is often a very small amount of spongy tissue which provides a semi-rigid base for the wings. However, in a small number of specimens the fruit develops a large amount of puffy inflated tissue over the body of the fruit, and this inflated tissue extends into the wings. The fruit becomes almost globular, with just rudimentary wings protruding at the margins. The venation of the exocarp also changes. Instead of 3–5 main veins extending as 'struts' into the wings, the exocarp venation becomes a reticulum of fine veins, giving the fruit a bizarrely different appearance.

Haloragis gossei var. inflata Orchard, *var. nov.*

A *H. gossei* var. *gossei* fructu differt: exocarpium in corpu fructus valde inflatum, mesocarpio spongioso; exocarpium venis tenuibus reticulatum.

Typus: 23 miles S of Learmonth, 29 Aug. 1960, *A.S. George* 1255 (*holo*: PERTH 03495930).

Very similar to *H. gossei* var. *gossei*, but differing in its fruits. Exocarp on body of fruit grossly inflated; mesocarp spongy; exocarp with fine reticulate venation (Figure 1C). See Orchard (1990) for illustrations of *H. gossei* var. *gossei* and Orchard (1975) for illustrations of that taxon and *H. trigonocarpa*.

Other specimens examined. WESTERN AUSTRALIA: 13 miles [c. 21 km] S of Bullara turnoff, 3 Nov. 1973, *H. Demarz* 4824 (PERTH); Dirk Hartog Island, Sept. 1972, *A.S. George s.n.* (PERTH); 116 miles [c. 186 km] S of Port Hedland, 26 Aug. 1960, *A.S. George* 1089 (PERTH); 20 miles [c. 32 km] S of Learmonth, 5 Aug. 1967, *A.S. George* 9172 (PERTH); 10 miles [c. 16 km] N of Quobba HS, N of Carnarvon, 3 Sept. 1970, *A.S. George* 10169 (PERTH); 25 miles [c. 40 km] N of Cardabia HS, N of Carnarvon, 4 Sept. 1970, *A.S. George* 10218 (PERTH); 7.25 km E of Cape Cuvier, N of Carnarvon, 25 Aug. 1995, *G.J. Keighery & N. Gibson* 902 (PERTH); Denham, 26 Sept. 1992, *M. Lewis* 21/92 (PERTH); Millstream Creek crossing, Watersupply

Road, Millstream area, 19 June 1990, *E.Leyland* MC 035 (PERTH); Summit Tanks, Millstream, Millstream-Chichester NP, 19 June 1990, *E.Leyland s.n.* (PERTH); Osprey Bay, 26 Aug. 1992, *E.Leyland* EL68 (PERTH); Learmonth, 17 Oct. 1964, *J.Thompson s.n.* (PERTH).

Distribution. Confined to Western Australia, mainly from near-coastal sites from Denham and Dirk Hartog Island (Shark Bay area) north to Learmonth, Exmouth Gulf. Three inland collections are known, two from Millstream–Chichester National Park, and the other from south of Port Hedland. (Figure 2)

Habitat. Most collections have been made very close to the sea, but only limited habitat information is recorded. *Lewis* 21/92 was found in brown sand near a track to the sea; *Keighery & Gibson* 902 was from a broad flat between dunes in red sand over limestone.

Phenology. Flowering and fruiting has been recorded from June to September.

Conservation status. No information is available on local abundance, but the variety is widespread, and not subject to any obvious threat. It is conserved in Millstream–Chichester National Park.

Rediscovery of *Haloragis platycarpa*

This species was described by Bentham in 1864 from a Drummond collection (1st Coll. No. 705) from the 'Swan River district' of Western Australia. Orchard (1990) considered it to be possibly extinct, as it had not been rediscovered for nearly 150 years. A small remnant population has now been found near Dalwallinu, Western Australia, and an amended description has been prepared.

Haloragis platycarpa Benth., *Fl. Austral.* 2: 478 (1864)

Illustrations. Schindler, *Pflanzenr.*, 23: 13L–N (1905); Blackall & Grieve, *How To Know West. Austr. Wildfl.*, 3: 469 (1965).

Sprawling, much branched ?perennial *herb* 30–40 cm, with vegetative parts glabrous except for scattered, papillose hairs 0.1–0.2 mm long on the stems. *Branchlets* 4–5 ribbed, angular–terete, becoming more or less terete with age, green, ageing reddish. *Leaves* alternate to subopposite (predominantly alternate in upper portion of plant), sessile, narrowly to very narrowly elliptic or narrowly to very-narrowly obovate, (10–) 15–45 mm long, 2–5 (–10) mm wide; base attenuate; apex acute; margin with (1–) 3–5 teeth in distal *c.* 2/3; teeth triangular to narrowly triangular, sometimes incurved, 1–3 mm long. *Inflorescence* an indeterminate spike of 1–3 -flowered dichasia in the axils of the primary bracts. Auxillary inflorescences borne in the axils of the upper leaves. Only the central flower of the dichasium is functional. Primary *bracts* leaf-like, narrowly to very narrowly elliptic, 8–10 mm long, 1–2 mm wide; base attenuate; apex acute; margin with (0–) 1–2 teeth in distal *c.* 2/3 to 1/2; teeth triangular to narrowly triangular, sometimes incurved, 0.1–0.4 mm long. Secondary *bracts* herbaceous, with a broad scarious margin, concave, elliptic to narrowly elliptic, 0.9–1.1 mm long, 0.2–0.3 mm wide; margin with 0–3 vestigial teeth. Tertiary *bracts* scarious, concave, narrrowly to very narrowly ovate, 0.3–0.5 mm long, 0.1–0.15 mm wide; margin entire. *Flowers* 4-merous, pedicellate; pedicel 0.2–0.3 mm long in flower and fruit. *Sepals* 4, ovate to broadly ovate, 0.6–0.8 mm long, 0.4–0.5 mm wide, minutely papillose abaxially and on margins, persistent to fruiting stage. *Petals* 4, herbaceous, with a broad scarious margin, hooded, concave and keeled, narrowly oblong, 1.6–2 mm long, 0.5–0.6 mm wide, glabrous or (more usually) minutely papillose on keel. *Stamens* 8; filaments 0.2 mm long; anthers yellow, non-apiculate, narrowly oblong, 1.4–1.5 mm

long, 0.3–0.4 mm wide. *Styles* 4, narrowly ovoid, minutely papillate (especially proximally); stigmas capitate. *Ovary* depressed pyriform to depressed globular, 0.4–0.6 mm long, 0.8 mm wide, not ribbed, densely minutely papillose, 4-locular. *Fruits* 1 per axil, depressed globose, 1.7–2.5 mm long, 2.2–4 mm wide, 4-locular, weakly 8-ribbed, especially distally, appearing more or less rugose overall, densely minutely papillose; endocarp and septa woody; exocarp swollen, more or less spongy. (Figure 1D–E)

Specimens examined. WESTERN AUSTRALIA: W.A., *s. dat.*, *J. Drummond* 1: 705 (MEL 39217, 39218, 39219); Dalwallinu [precise locality withheld for conservation purposes], 6 Oct. 2000, *M. Hislop* 2134 (CANB, PERTH).

Distribution. Known only from the environs of Dalwallinu, in the Avon Botanical District of south-western Western Australia. None of the Drummond collections have accurate locality data (cf. Orchard 1975). (Figure 2)

Habitat. Hislop 2134 was found growing in bare brown loam in low woodland of *Acacia acuminata* with *Grevillea levis* and *Pimelea avonensis*.

Phenology. Hislop 2134, collected in early October, is in young flower. Plants from the same population were in mature fruit in late November. Drummond's collections are undated except as to year.

Affinities. H. platycarpa seems to have no very close relatives. It belongs to that fairly generalised group of species which in Western Australia includes *H. scoparia*, *H. hamata* and *H. foliosa*, but differs from all of these in its small fruit with somewhat inflated pericarp and densely papillose indumentum. In its inflated pericarp it resembles *H. uncatipila* from central Australia, but that species is larger in all its parts, including the fruit, and the indumentum is of hooked rather than short papillose hairs. The resemblance is more likely to be attributable to convergence than to a true relationship.

Conservation status. Conservation Codes for the Western Australian Flora: Declared Rare Flora. Presently known from only one population (*Hislop* 2134). Further fieldwork is required to determine whether any additional populations exist.

Haloragis foliosa

Haloragis foliosa, once one of those species of the coastal plain known only from original and inadequate material (Orchard, 1976, 1977), is now relatively well represented in collections, although all specimens are from a relatively restricted area between Dongara, Eneabba and the coast. It seems, like many *Haloragis* species, to be favoured by disturbed habitats, and is frequently collected from scraped areas on road shoulders. It can be distinguished from *H. scoparia* and *H. aculeolata* by its 4-locular ovary and fruit. Specimens additional to those previously reported are cited below:

Specimens examined. WESTERN AUSTRALIA: Southern Beekeepers Reserve (Reserve 36053), ENE of Cervantes, 29 Oct. 1991, *E.A. Griffin* 6655 (PERTH); Remote part of Beekeepers Nature Reserve 24496 near the western end of the Mt Adams Road, 10 Jan. 1995, *R.P. Hart* 2440 & *D. Corbyn* (CANB, PERTH); Bay of Plenty, N of Leeman, 5 Dec. 1994, *G.J. Keighery* 13198 (PERTH); 15.75 km N of Coolimba–Eneabba Road on coastal road, 30 Apr. 1992, *S.J. Patrick* 1043 (PERTH); Cliff Head Road, 10.8 km S of intersection with Brand Highway, 6 Jan. 1992, *S.J. Patrick* 935 & *A.P. Brown* (PERTH).

Distribution. Confined to heaths between Dongara, Enneaba and the coast.

Habitat. Most collections are described as growing in shallow white, yellow or grey sand over limestone. Several were from scraped soil on road shoulders. Associated species include *Acacia rostellifera*, *Melaleuca* sp., *Anthocercis littorea*, *Santalum acuminatum*, *Melaleuca huegelii*, *Beyeria* sp., *Trymalium* sp., *Salsola kali*, *Thryptomene* sp., *Lomandra maritima*, *Melaleuca systena* and *Loxocarya flexuosa*.

Phenology. Specimens have been collected in flower in October to December, and in fruit in January to April.

Conservation status. Population sizes range from 7 to 200+ individuals. Several populations are in Nature Reserves. Conservation Codes for the Western Australian Flora: Priority Three.

Haloragis aculeolata and Haloragis scoparia

In earlier papers (Orchard 1975; Orchard 1990) the status of the two species *H. aculeolata* and *H. scoparia* was indicated to be uncertain. Both were known from their type collections and from very few, rather scrappy, other collections. All material was 50 or more years old, and there appeared to be the possibility that the two taxa were extinct. They were distinguished principally by indumentum characters.

Since 1990, although a few collections have been made, adequate material for a re-evaluation of the species has proven frustratingly elusive. One hypothesis to be tested was that the two taxa only represented extreme forms of a single variable species, ranging from glabrous to scabrous plants, and with ovaries and fruits ranging from 1–4 locules. This is still possible. However, re-examination of previous collections, together with a small number of new specimens, has provided better characters for their separation, and it is proposed here that the species be maintained.

The degree of scabridity is now considered inadequate to distinguish the two species, but they do differ markedly in their sepals. *H. scoparia* has ±cordate sepals, about as long as wide, with a fringe of coarse scabrid hairs on the margin (sometimes rather sparse). In *H. aculeolata* the sepals are deltoid to narrowly deltoid, usually longer than broad, and lack the marginal hairs. The number of locules seems to be variable, with new material of *H. scoparia* having 2-locular ovaries and fruit, and that of *H. aculeolata* 1-locular or 3-locular fruits. The fruits of *H. aculeolata* are borne in clusters of (1–) 3–7 in the axils of the bracts, not singly as previously reported. New material of the two taxa is detailed below.

Haloragis scoparia Fenzl

Specimens examined. WESTERN AUSTRALIA: without definite locality, 1854, *J.Drummond* 82 (PERTH); Ellis Road, Yalgorup National Park, 9 Apr 1994, *G.J.Keighery* 13023 (PERTH); Cannington, 26 Dec 1901, *A.Morrison s.n.* (PERTH) – the last previously included in *H. aculeolata*.

Distribution. Known definitely only from Cannington (eastern suburbs of Perth) and the Yalgorup National Park, south of Mandurah, both on the Swan Coastal Plain.

Habitat. This appears to be a plant of wetter areas. No details of habitat are known for the Cannington

collection, although it may have been from swampy or riverine habitats. Habitat details for *Keighery* 13023 are: "old lake bed; winter wet. *Eucalyptus rudis* over *Melaleuca polygaloides* [= *M. incana*] shrubland. Black calcareous clay over limestone."

Phenology. Flowers are known in December and April; fruits have yet to be collected on a fully dated specimen.

Conservation status. In Yalgorup National Park the species is described as "common throughout the area". However, this is the only known recent collection of the species. Conservation Codes for the Western Australian Flora: Priority One.

Haloragis aculeolata Benth.

Specimens examined. WESTERN AUSTRALIA: 25 km E of North Bannister, 5 Dec. 1996, *R.Davis* 1613 (PERTH); Lake Preston, northern end, on road to Preston Beach, Yalgorup National Park, 16 Mar. 1989, *G.J.Keighery* 11375 (PERTH).

Distribution. This species is known from only three definite localities, widely scattered in south-western Western Australia: at Lake Preston on the Perth Coastal Plain, at North Bannister, west of Pingelly on the plateau of the Darling Range, and at Toolbrunup in the Stirling Range. The *Morrison s.n.* collection from Cannington previously assigned to this species (Orchard, 1975, 1990) is now considered to be *H. scoparia*.

Habitat. Label data for *Keighery* 11375 states: "*Eucalyptus gomphocephala* tall open woodland. Valley. Black coarse shelly sand over limestone.", while *Davis* 1613 records: "Valley, ridge. Wetland. Littered gravelly brown sandy clay over granite. Woodland."

Phenology. Fruiting collections have been recorded from December to March.

Conservation status. At the North Bannister site the species was described as abundant. Further targetted collecting is required to resolve the wide disjunctions in the known distribution and to provide information on abundance and conservation status. Conservation Codes for the Western Australian Flora: Priority Two.

***Haloragis glauca* Lindl. forma *glauca* new for Western Australia**

Haloragis glauca, formerly recorded only for the Northern Territory, Queensland, New South Wales and north-western Victoria (Orchard 1975, 1990) has now been collected in Western Australia, from Fitzgerald River National Park on the south coast of the State. Both collections were from winter-wet, summer-dry swamps, similar habitats to those recorded for many eastern populations. This locality is far removed from other populations of the species, the nearest being 2000 km away in north-western Victoria and western New South Wales. Do they represent relict populations or are they introductions? The two WA collections are somewhat variable in flower and foliage characteristics, one having a scabrous ovary/young fruit, the other having a glabrous ovary. In both the bracteoles are 1–1.3 mm long, somewhat longer than those in eastern populations (0.7–0.8 mm), and the sepals are deltoid, about as long as wide, while in most eastern populations the sepals are somewhat longer than wide. The young fruits are ±globular, one of the forms present in eastern plants. Eastern populations vary widely in their

character states, as might be expected from such a widespread taxon that perennates at least in part vegetatively. If these populations had been discovered in eastern Australia, they would have been considered as just another minor variation on the pattern exhibited by *H. glauca* forma *glauca*, and for that reason, their slightly anomalous set of characters is here not deemed sufficient to recognise the Western Australian population as taxonomically distinct. On balance, it seems most likely that this population has been isolated from those in the east for some time, but is not distinct enough to be recognised as a separate taxon. Whether it is a natural relict, or the result of long-distance (non-human) dispersal is not clear, but it should be treated as a native species in Western Australia.

Specimens examined (all PERTH). WESTERN AUSTRALIA: Quiss Swamp, Fitzgerald River National Park, 21 Nov. 1986, *K.R.Newbey* 11411; Fitzgerald River National Park, 15 Dec. 1986, *K.R.Newbey* 11420.

Distribution. In Western Australia known only from Fitzgerald River National Park. Otherwise distributed widely in drier parts of the Northern Territory, Queensland, New South Wales and Victoria.

Habitat. Habitat notes in the two collections are similar: *Newbey* 11411 was from "Floor of swamp that rarely fills with water; grey clay loam. Low woodland of *Eucalyptus occidentalis*." *Newbey* 11420 was from "swamp on gently undulating plain, winter-wet/summer-dry sandy loam. *E. occidentalis*" where it was described as a "colonial semi-woody plant dying off during late summer".

Phenology. Flowers are present in November and December, young fruits in mid-December.

Affinities. Part of the *Haloragis aspera/H.heterophylla* complex, low semi-woody perennials perennating by deep rhizomatous rootstocks.

Conservation status. In Western Australia all plants are conserved within a national park. In eastern Australia, this species is widespread and common, and in some areas is even considered a weed of cultivation.

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